PROFILE MONITORS

Gianni Tassotto

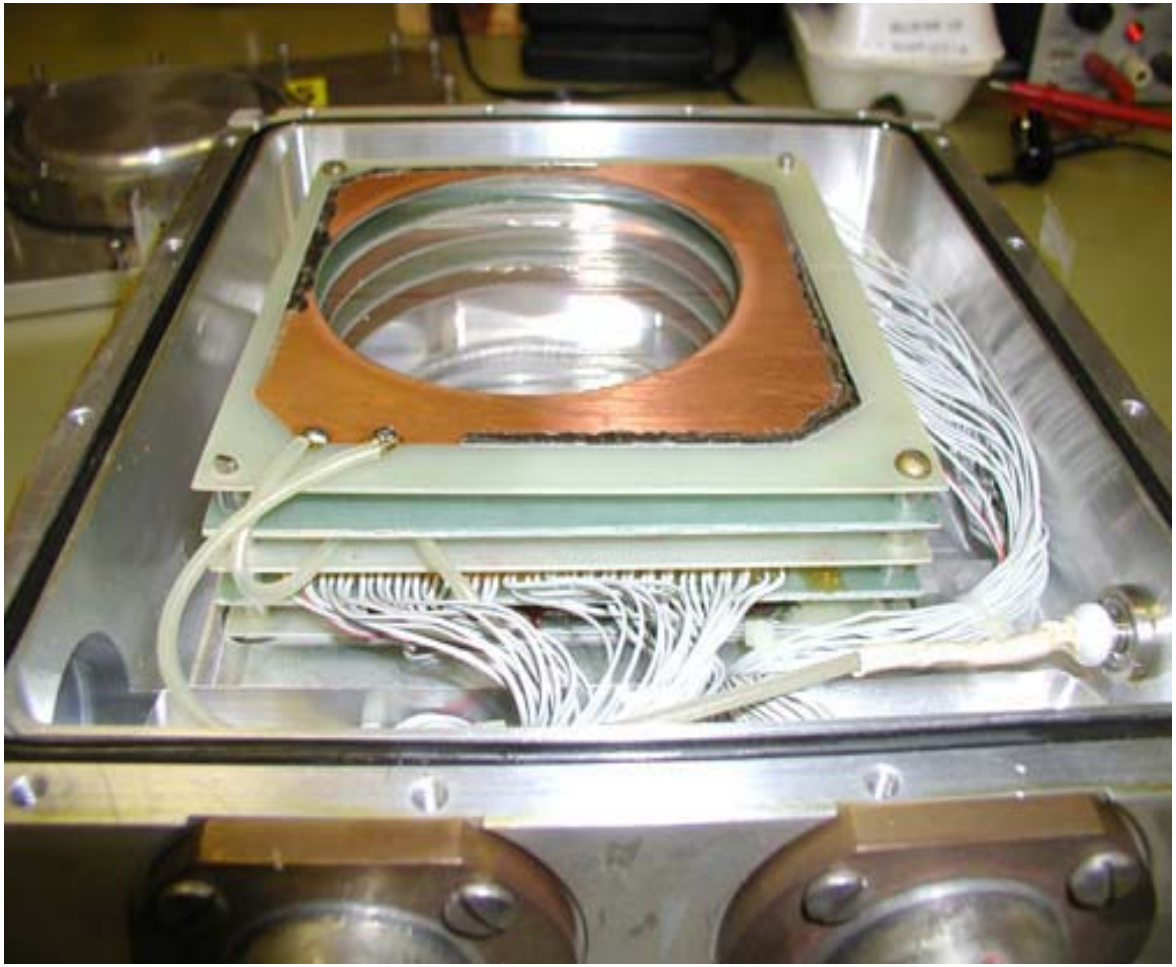
Types

- (SWICs)
- Wire SEMs
- SEEDs
- P-Bar TSEM
- Multiwires

Wire SEMs

- Used in Neutrino Fixed Target beamline
- Vacuum box attached to beam pipe
- Vacuum port
- G-10 Boards
- X, y plane and 3 HV planes
- 64 pin feedthroughs for signal

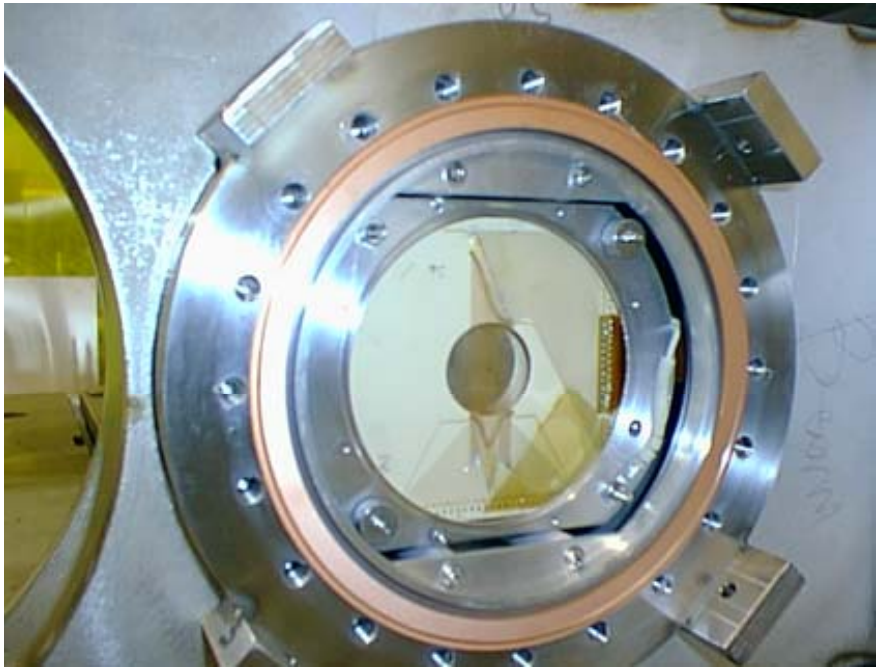
Wire Planes



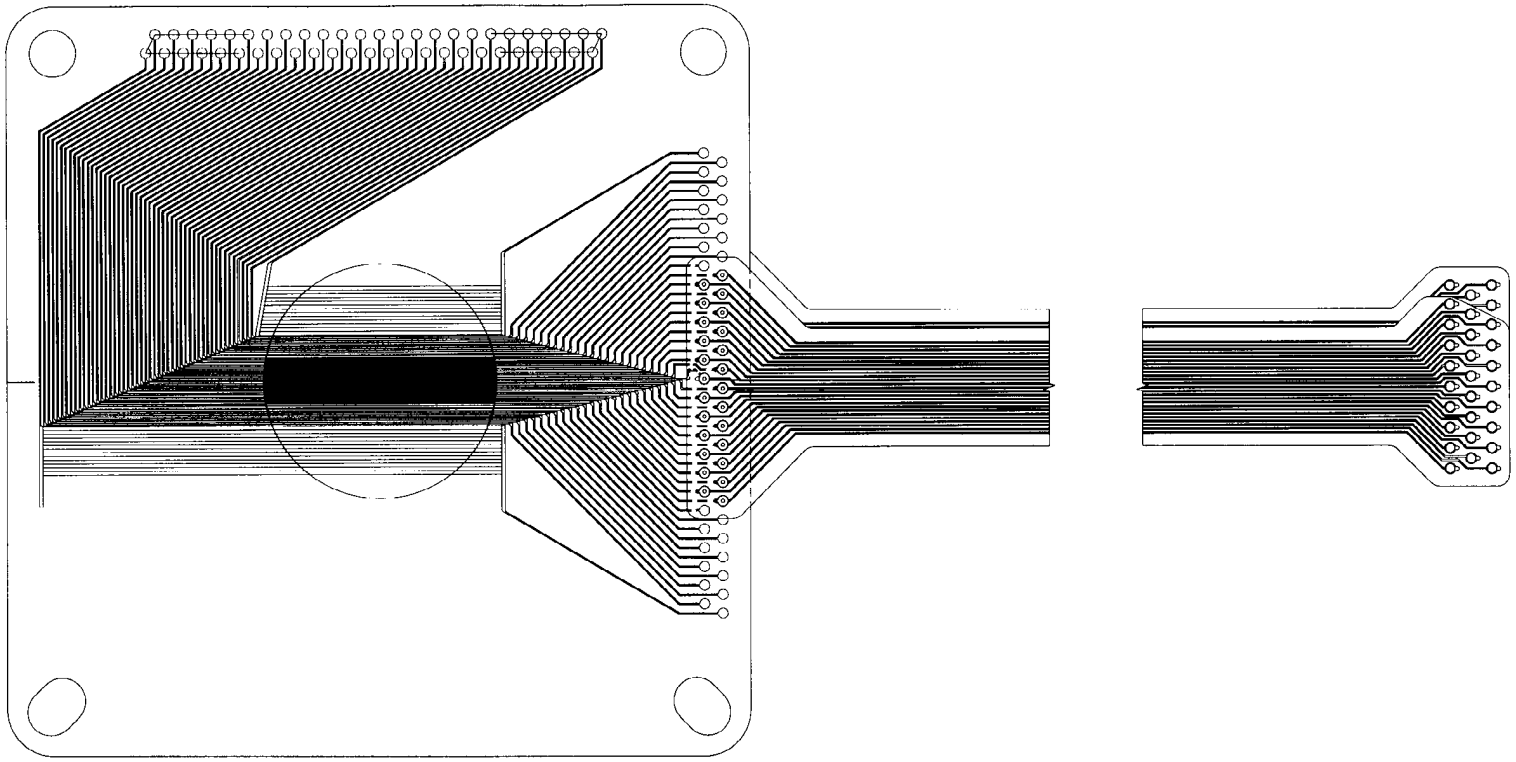
SEEDs

- Secondary Emission Electron Detectors
- Built for KteV and NuTeV
- Separate vacuum chamber with ion pump
- Ceramic boards
- Wire pitch 0.5 mm, 0.25 mm, 0.125 mm
- 3 Clearing field planes
- To maintain tension wires had to be epoxied to surface

SEED Installation

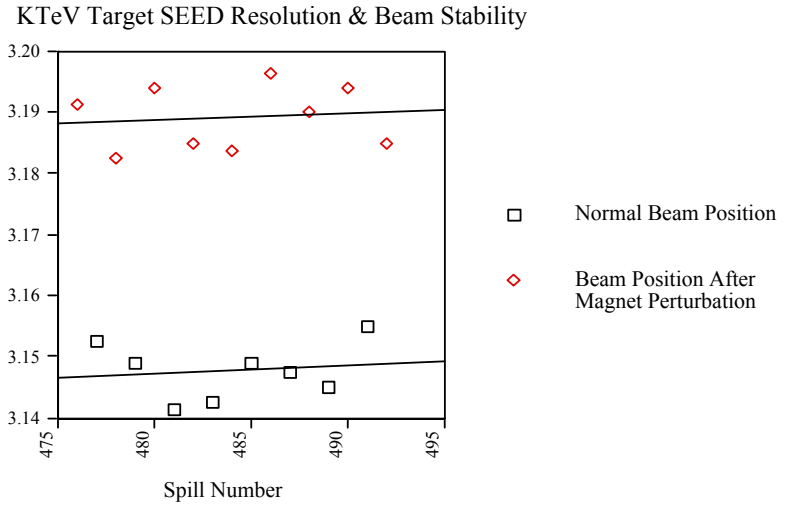


SEED Ceramic Boards



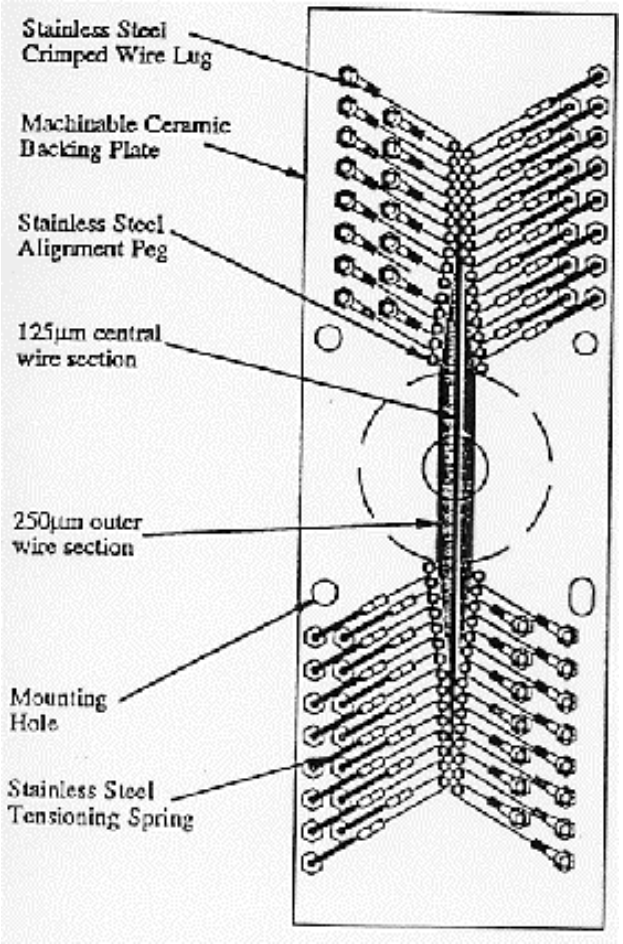
SEED Beam Stability

- "Secondary Emission Detector for Fixed Target Experiments at Fermilab"
- Beam sigma 0.22 mm
- I=5E12 @ 800 GeV
- SEE dropped 20% after 1 year running
- Beam stability <10 micro meter



P-Bar TSEM

- Target Secondary Emission Monitor built following J. Krider "A Multiwire Secondary Emission Beam Profile Monitor with 20 μm Resolution".
- Chamber construction:
  - Wire: Ti, 50 μm Dia
  - Pitch: 125 μm
  - Spring tension: 95 grams
  - Resolution: 10 μm
- Material :
  - 2 signal planes
  - 3 25 μm Ti bias foils
  - 3 38 μm Ti beam windows
- Lifetime : After 3 months:
  - Wire fatigue
  - Spring tension
  - crimping



Multiwires

- Original Design: M. Shea -1972
- Continued by J. Lackey
- Circular vacuum can
- G-10 board - Separate x, y planes
- No clearing field
- Signal strips : - 0.002” Nichrome
  - 24 channels
  - spacing: 1, 2mm

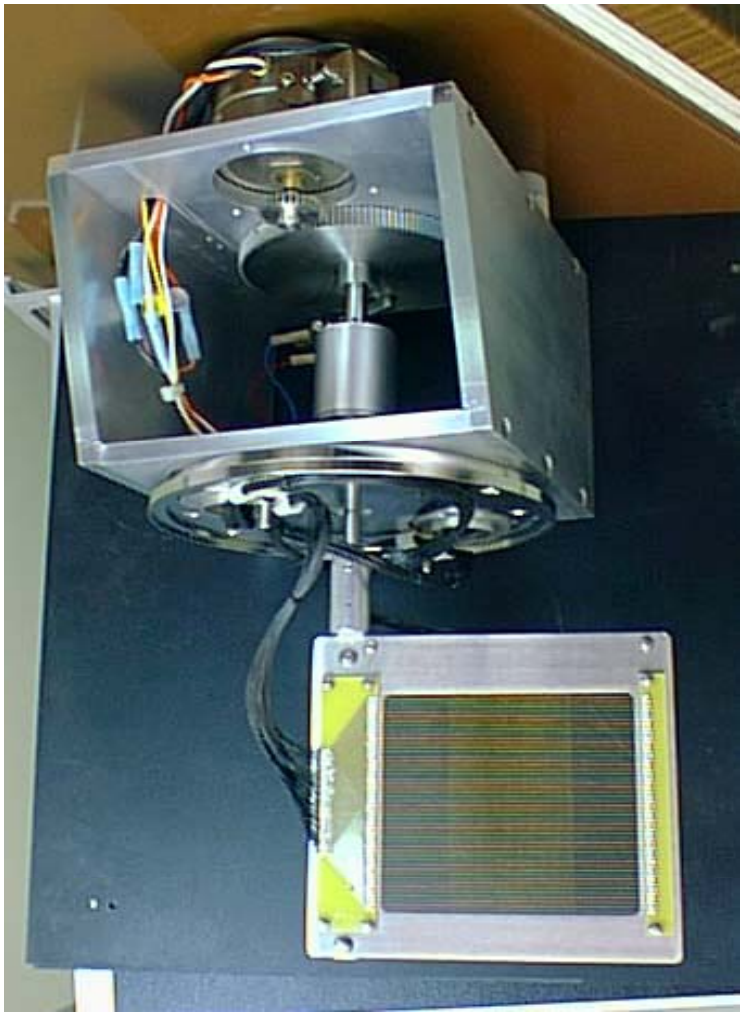
- Later changed - 0.003” AuW
  - 48H/48V
  - 2, 1, 0.5 mm

- Limitations:

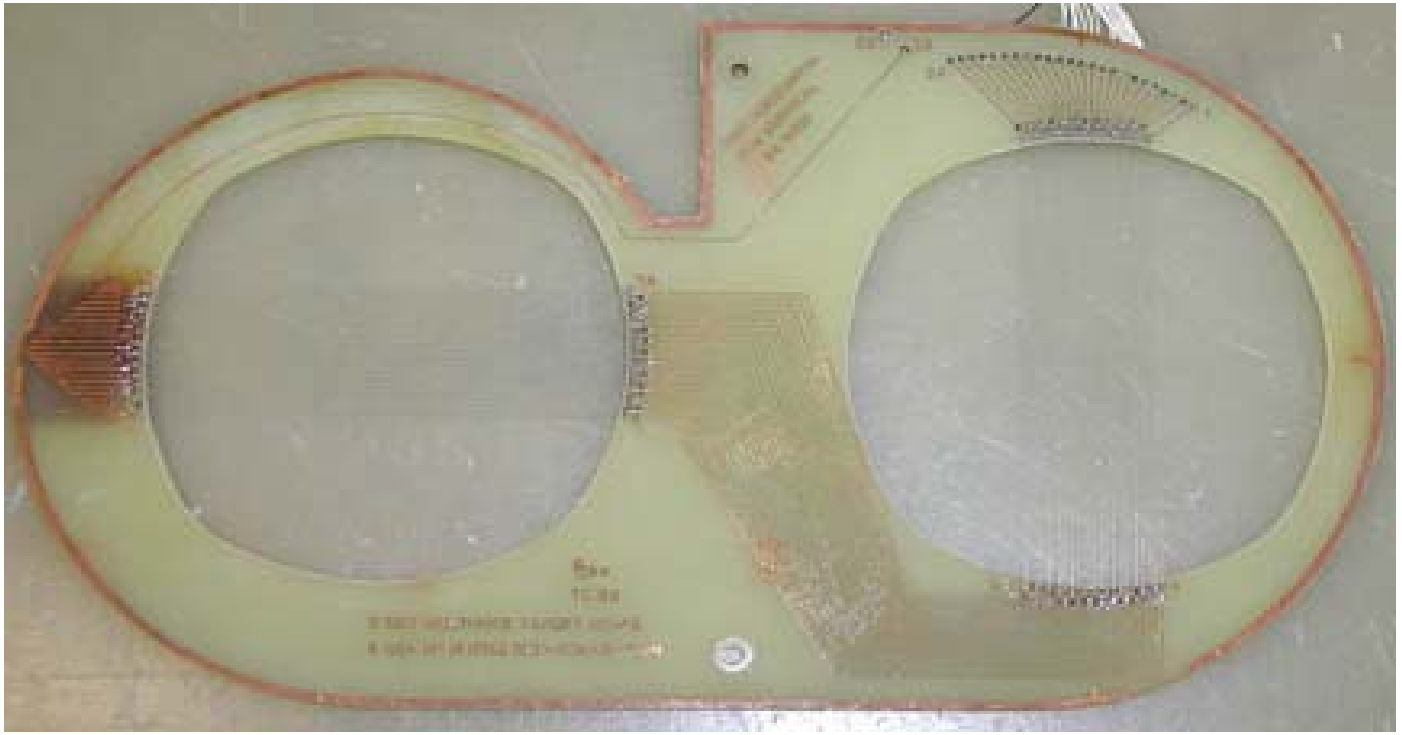
- Poor mechanical stability
- No alignment provisions
- Loss of wire tension due to different coefficient of thermal expansion between stainless steel frame and the tungsten wire

- $\lambda w = 4.6$ (ppm-degree C)
- $\lambda ss = 17$
- $\lambda inv = 1.17$
- $\lambda alum = 6.5$

Vacuum Can/ Wire Plane assembly

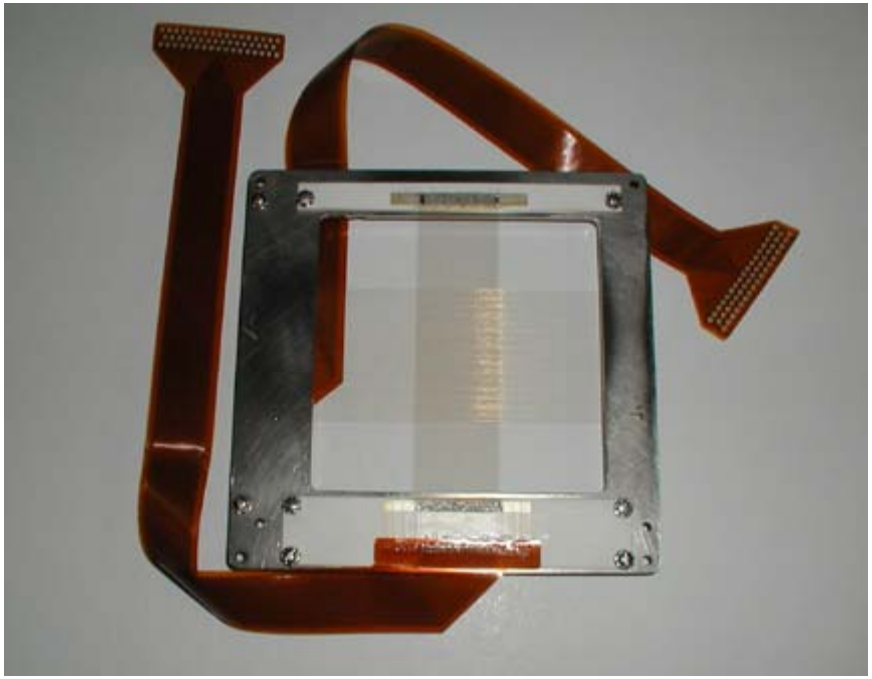


Wire Planes



Wire Planes

Ceramic (Alumina 96%)



Arlon (Cuclad teflon/fiberglass)

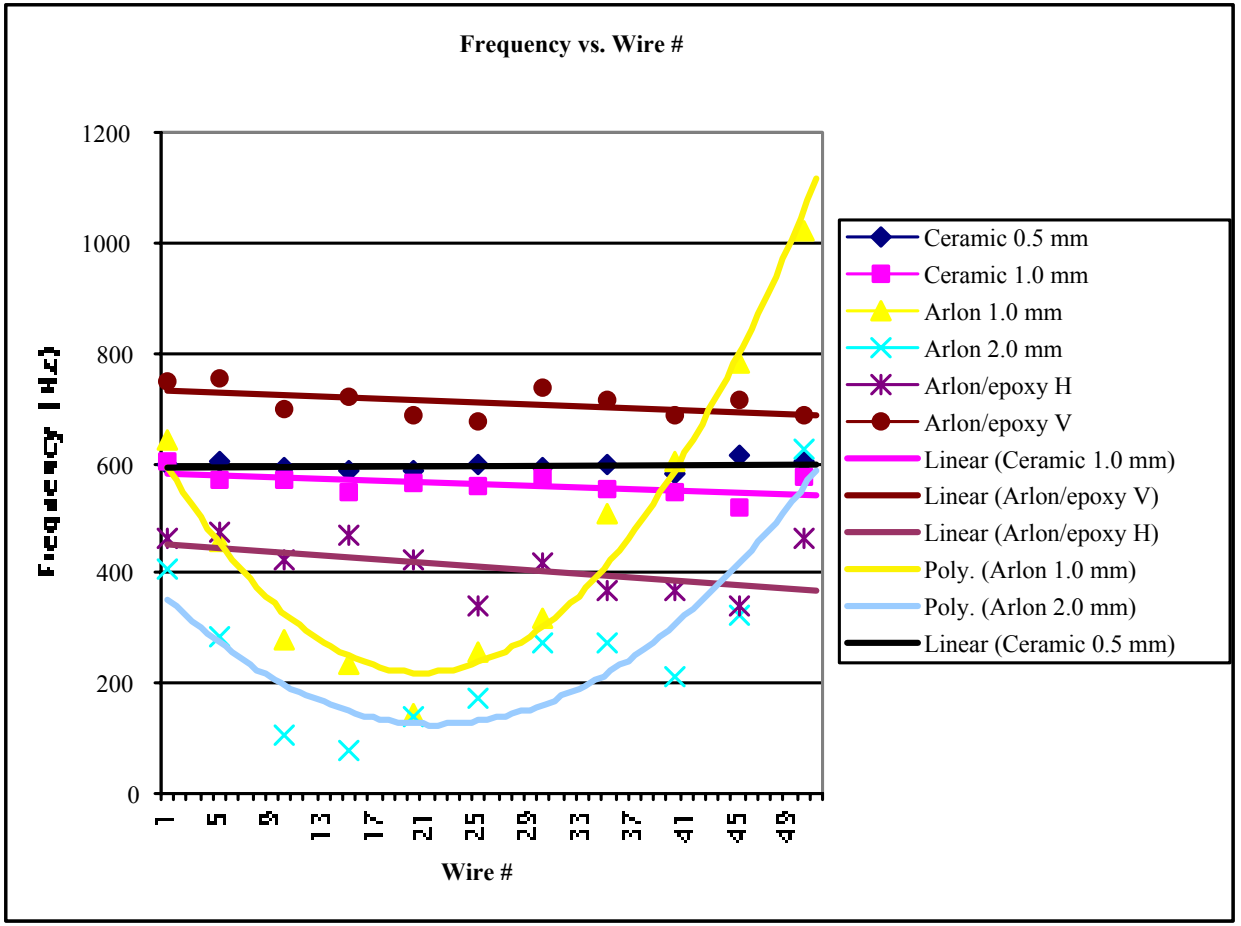
Wire Tension

- John Krider measured the tension of the wires following:

- 1. FN-385. “A sensitive instrument for measuring wire tension in multiwire proportional and drift chambers”. By T. Regan.
- 2. TM-1125. “A sensitive and simple method for measuring wire tension”. By M. Atac and M. Mishina.

- The tension $f=1/2L\sqrt{T/\mu}$ Where:
- f= resonance frequency (Hz)
- L= wire length (cm)
- T= tension (grams cm/sec^2)
- μ= Mass/unit length
- For 80 g of tension we should read 450 Hz

Wire Tension



Upgrade/Conclusion

- Designing a dual plane assembly:
- Carl Lindenmeyer has just about completed the mechanical improvements:
  - 1. 2 wireplane assembly
  - 2. Motor assembly
  - 3. Rotary Feedthrough made by Thermo Vacuum Generator
  - 4. Nonrotating flange

- John Krider has investigated sources of loss of tension:
  - 1. Transfer frame small radius
  - 2. Cut wires after soldering

- Last:
  - evaluating the use of invar as a possible replacement for the Board holder
  - Ceramic wire plane.